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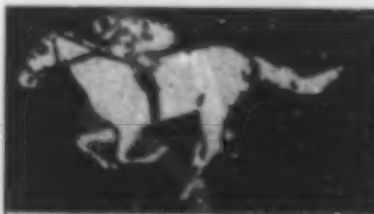
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"Always plan for something bigger than you really need."

out that network managers will probably have to use four separate networks to wire up a building: a star-shaped twisted pair for telephony, a similar network for dumb computer terminals, a baseband coaxial or twisted-pair LAN like Ethernet, and a broadband coaxial or fiber-optic LAN like Wangnet.

"The result," concludes Camras, "is often a costly mess that offers the minimum amount of system flexibility at the maximum price. The prospects for service integration under these conditions could not be more remote."

Nevertheless, the U.K. boasts more LANs than any other European country. Over 6,500 networks have been installed, according to consultants at BIS Applied Systems. 1983 saw major growth in the use of LANs, and there is now hardly one major U.K. company that hasn't at least experimented with these nets.

The pathfinders, however, are not finding the going easy. Gerry Roff, senior consultant with BIS, believes that users are stymied by problems of network management and the lack of software. Roff also complains about the poor addressing facilities for linking networks across the public telephone system.

"People are still using LANs for unsophisticated and simple applications," explains Roff, "and much of the difficulty comes from concentrating too much on the technical aspects, instead of focusing on how LANs are going to be applied. As a result, lots of people have bought networks and found that they haven't done what they intended."

ITL, the U.K. distributor of Sytek's Localnet 20 (Cablestream), reports that one of its customers, the Michelin tire company, replaced its entire fiber-optic system after experiencing difficulties with the network. Other users are also not making the most of their systems. Wang, for instance, has yet to find a British buyer who's prepared to use all five bands available on Wangnet for voice, image, and data transmissions.

Indeed, most British LANs are used in traditional dp applications to connect either terminals or micros to the mainframes. British American Tobacco (BAT) in Woking, England, claims that this style of networking has boosted the company's revenues by over \$5 million in the past two years.

BAT was one of the first users of Rascal Milgo's Planet system, a U.K. ring network. "There have been teething problems, but in general the system has exceeded our expectations," says BAT's head of management information services, Bruce Shilstone.

"We've saved more money than we thought we would."

Comparing the wiring costs of a Planet connection with a conventional point-to-point link, Shilstone estimates he has trimmed costs by between \$2,500 and \$10,000 per terminal. "But our main savings," he declares, "have been in reconfiguration. It just takes a few instructions to the director [a module that holds address data] to enable a user to access computers never issued before."

BAT, which has three networks that serve 150 terminals, has yet to go full tilt into office automation. Dp boss Shilstone is content to take the long-range view. BAT can in fact go beyond the local dp domain, since it already has access points in each of its offices.

Local processing doesn't get much more local than it does on an island 70 miles off the English coast. The Isle of Man is home to four LANs. They are used by the 25 departments of the Isle of Man government.

Two years ago government dp manager Maurice Mawdsley began to install Hi-Net networks to link groups of users. "What we wanted was a cheap entry point to the mainframe and the opportunity to share resources," explains Mawdsley.

The network Mawdsley installed is the biggest seller in Britain. Digital Microsystems, which developed Hi-Net and associated workstations, has sold 1,700 units in Britain and 3,500 worldwide.

HOLDING HANDS OF LAN USERS

Mawdsley says that the system is not always easy for end users to operate. "It's all very well saying these things are user friendly, but you still have to hold the hands of users," he maintains.

Few network managers have as much handholding to do as ESOC's Blank. ESOC belongs to the Paris-based European Space Agency (ESA), which operates about 350 computers all over Europe—40 mainframes, 110 superminicomputers, and 200 minicomputers. The large number of systems, Blank points out, not only makes it difficult to establish a local datacom network, but also makes it tough to have the right net for long-range transmission among the various ESA centers.

Blank says that ESA's internal communications requirements were completely underestimated. Two pilot LANs that communicate with each other were then installed, one in Noordwijk, in the Netherlands, and one in Darmstadt, West Germany. This year ESA plans to expand the project by connecting the computing

centers in Paris and Rome.

From a local networking standpoint, it was important that ESA have a system that could cope with future expansion. So, ESA decided on a cable TV LAN setup. In the Netherlands there are three networks with 150 ports each. In Darmstadt there is a network with 300 ports that will be expanded to 500 this year. The data is transmitted over the net in both synchronous and asynchronous modes.

"The whole area of LANs was a virgin territory for us," recalls Blank. "We dared to leap into the dark."

Colin Bradley, systems services manager at Land Rover, the British four-wheel drive vehicle manufacturer, took his second leap into LAN land last year when his company transferred the work being done at 14 factories to one single 200-acre site in Solihull, Great Britain. In the process, Land Rover installed an ITL Cablestream network that Bradley claims is the third largest broadband LAN in the world.

The new network replaced a CATV system that Bradley says "was starting to cause major concern due to a lack of network design in the early stages and the inflexibility of the installed equipment." It allowed users to connect to only one computer. Land Rover ripped out 10 miles of cable last Easter, replacing it with a new system.

"Always plan for something bigger than you really need," advises Bradley. "We could not foresee two years ago that our network would grow to 18 miles in length." The rejuvenated LAN has two gateways to SNA and 3703 syscs with iefix, vidcotex, and X.25 links in the works.

In Scandinavia, local area networking is evolving at a slower pace than it is in Britain. One person who's stepping up that pace is Jukka Castrén, dp manager at Kansallinen Osake Pankki, Finland's largest bank. Castrén is in the process of determining which LAN approach will best augment the bank's existing dp network.

Chances are the bank will adopt one of IBM's LAN systems, since the existing network is being converted to SNA. The bank's on-line system, which has been operational since 1975, was the result of a major development effort between the bank and Nokia Data, Bull's representative in Finland. Standard software was not able to cope with the bank's needs, so extensive tailoring was necessary. The system, which supports 3,000 terminals, works well, but it still is not flexible enough, according to Castrén, who finds it very difficult to implement major changes.

To solve this problem, the bank decided last year to come up with a new gen-

...to the Japanese to come up with the Total approach to networking. That's what Toshiba Corp. did when it developed the Toshiba Office Automation and Telecommunications Architecture and Language (TOAL) network.

The net, considered to be one of Japan's most advanced local area networks, went into operation one year ago in Toshiba's new 40-story headquarters building in Tokyo.

Each floor is linked by 10 optical fiber channels, each having a data transfer rate of 100Mbps. The network, which extends horizontally in an Ethernet-like configuration, connects a slew of terminals, servers, word processors, fax machines, and minicomputers located throughout Toshiba's high-rise headquarters.

Toshiba produces all the hardware and software used in the net, except for

the mainframe, which is an AS/400 system supplied by NEC Corp. The company has also made one sale of the system to Meiji Mutual Life Insurance Co. in Tokyo.

But does the Total network work? Toshiba, by its own admission, is a neophyte at networking. A quick glimpse at the offices not included on Toshiba's tour of its "network showcase" reveals plenty of paper piled on desktops. So although the network works, many Toshiba employees still seem to prefer working in more traditional ways.

"Realizing the full potential of our network is an ongoing process," admits Takao Hayashida, senior manager of Toshiba's information systems business group.

"The investment is made. Now it's a matter of learning how to use what we've got."

—Thomas Martin

eration of the system that could run on IBM mainframes. The availability of SNA was, of course, a telling factor. The new system is expected to be in pilot operation beginning next year, with full replacement of the present system scheduled for 1990.

Norwegian service bureau Fjerndata has also taken the IBM road to networking. "More and more we live in an IBM-dominated world," declares Oer Horgen, head of Fjerndata's telematics department. "In many areas IBM is a generation ahead," he argues.

PEOPLE-INTENSIVE NETWORKS

Horgen runs an SNA-based star network. Six 64Kbps digital trunk lines along with 200 ordinary leased lines support about 100 batch and 2,000 interactive terminals. It is a tough network to manage, asserts Horgen, who says that monitoring line quality and detecting errors on the net are becoming more and more demanding tasks. "We now have a network operations group of eight to 10 people working two shifts," he explains. "While computer operations are becoming less and less people intensive, network operations are on the opposite track. Besides monitoring line quality and uptime, we also sample subjective opinions of our users every week. We often find that measurements and opinions of quality differ significantly."

Horgen also has other hassles when it comes to getting lines from Norway's sluggish telephone authority, Televerket. "When customers make a decision about extending the network they should be able to implement the extension quickly," complains Horgen. "We cannot wait for Televerket's three- to six-month delivery. In an operation like ours we must have excess communications capacity."

This line problem is being tackled by all the telephone authorities across Europe, particularly the French DGT, which is investing massive amounts of money to try to improve the national communications network.

The French packet switched data service Transpac began operating in the early '70s, just after the world's first national data net was established across the border in Spain. This year the packet net will be enhanced considerably. The DGT will also start offering new data communications services—Transfix, Transcom, and Transdyn. Both Transfix and Transcom will be solely for transmission within France, whereas Transdyn, which will use France's recently launched Telecom 1 communications satellite, will transmit throughout Europe.

FIG. 1
LOCAL AREA NETWORK MARKET FORECAST*



*1985-1990
SOURCE: PRIST & ASSOCIATES

INTERNATIONAL

"What is needed now is for costs to fall, so we can do more."

Marc Auzet, manager of professional products and services in the DGT's commercial division, believes that these three services will give the user a comprehensive choice of data communications services that will be the core of an integrated digital network, and that will ultimately handle both voice and image.

In all its datacom developments, the DGT is wedded to the principle of international communications standards. The International Standards Organization's Open Systems Interconnection (OSI) standard is the bible of telecommunications in France and the DGT is one of its apostles. "We use the norms laid down by international bod-

ies," explains the DGT's Henri-Alain Combet. "The problem is to see if suppliers will design products that correspond to these international standards. From the user's point of view, it is important to have stable and published interfaces. Users don't like to be tied to a single supplier."

OSI standards are of particular interest to the Banque National de Paris (BNP), France's second largest bank. BNP currently has a dual-circuit network with both IBM and Bull hosts. Rene Regnard, head of the network systems design division in the bank's dp department, outlines BNP's strategy. "Our long-term aim is to have a single OSI network for all machines, which is not possible at the moment," he says. "The SNA network for IBM machines will be linked via Janus [Bull's communications software] to Bull's DSA network. It will be a great advantage to have a better choice of terminals—unrestricted by the problem of communications protocols."

French department store group Nouvelles Galeries has a highly developed network that uses Transpac for long distance communications. It has 130 connections to the packet switched data network, which is managed by an IBM 3083, with two 3705s. Leased lines are used for local links and for a few long distance connections when there is a large volume of data to be transferred. "Our networks operate mainly on Transpac," explains Nouvelles Galeries' systems and networks manager, Marc Raffali, "but Transpac is not economic for short distances, so we use leased lines. We have about 40 in Paris alone."

Therein lies one of the most significant obstacles to true integration between dp and communications technologies. Europe's network managers, wading through the technical and management problems of establishing and monitoring a network, can do little about the even thornier issue of cost. When it comes down to the bottom line, networking is still an expensive business.

"What is needed now," declares BNP's Regnard, "is for costs to fall, so that we will be able to do more. So far, telecommunications tariffs haven't fallen, unlike dp costs. We are waiting for that drop that will enable us to invest in new services."

So, while the promised land of integrated computer and communications systems may be in sight, it is an expensive and uphill climb to get there. That climb often causes even the most cautious network planners to get trapped in their own nets.®

Also contributing to this article were Alain Blaes, James Etheridge, Peter Hidas, and John Lamb.

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 CONTROL DATA

What to watch for as the competing network technologies line up at the gate.

HANDICAPPING LANS

by Martin Pyykkonen

It is a package of media, transmission devices, interface units, network-management hardware and software, end-user devices, and applications software for the provision of communication between dissimilar nodes in an intrabuilding or intracampus environment. In other words, it is a local area network. Herewith, an update of what's current and a forecast of what's likely to happen to LAN technology and to the LAN market.

LAN technology has three major elements: transmission media, network topology, and network access.

The four media currently used in LANS are twisted pair, baseband coaxial cable, broadband coaxial cable, and optical fibers. While each offers its own benefits for LAN applications, the trend in LAN installations is toward optical fiber, being pushed hard by AT&T, IBM, and Japanese vendors including NEC, Hitachi, Fujitsu, and Toshiba.

AT&T, IBM, and other domestic vendors will still consider alternatives to optical fiber, but the Japanese are basing virtually all of their LAN schemes on optical fiber. They may have problems. Despite optical fiber's technical benefits, its higher initial costs and more difficult implementation will limit user acceptance until later in the decade.

Bus, ring, and star are the three major LAN topologies (Fig. 1), each of which has advantages and disadvantages. Choosing one depends on criteria such as information throughput, network flexibility and expandability, device connectivity, cost, and reliability.

About 60% of the major products in the LAN market are bus oriented. The primary benefits of a bus include high-speed transmission, unlimited LAN distance, easy user node reconfigurations, and high network reliability. Using this topology, the best information throughput is obtained in light and sporadic traffic condition.

The ring is a newer, more sophisticated, and still evolving topology. While the entire ring can be brought down by a single node failure, limiting network reliability, ongoing standards development, and low cost per node will make the ring topology popular in future LANS.

STAR TOPOLOGY RELIABLE

The star topology provides greater network reliability: only the failure of the central node can disrupt the entire network. But users can expect to pay more for this greater reliability.

Access methods can be either centralized or distributed within the LAN. Centralized access allocates a time slot or frequency channel to a particular user node. This is the access principle behind the circuit switching of PBX networks.

Distributed access is predominant among baseband, broadband, and token-ring LANS. Within distributed methods, Carrier Sense Multiple Access (CSMA) and token-passing access are available. The CSMA method is statistical: an individual node senses whether the network path is available for transmission, and only one user node is allowed to occupy the channel at a time. The token-passing method is deterministic: access will be permitted sequentially, determined by possession of the network token.

LAN hardware and software vendors face various user-acceptance hurdles, one of the most serious being unresolved network standards. End users cannot rely on these standards until they become truly established, a process that could take two to three years.

While the LAN market will grow vigorously for the next 10 years, there will be more vendors dividing it. Traditional LAN vendors, including Digital Equipment, Wang, and Xerox, will offer network solutions based upon their installed base of computers and related office equipment. Communications equipment vendors, primarily AT&T, will offer LANS built upon ex-

isting wiring networks and new universal wiring plans.

The most significant competitive threat to the LAN suppliers will come from PBX vendors selling products with enhanced data communications capabilities. This could open new opportunities for LANS, since LANs and PBXs offered in the next two to three years will be more compatible than those available today.

Major application areas for LANS are office automation, factory automation, education, R&D facilities, and military and other government installations. Because of the proliferation of office products with communications capabilities (including personal computers, word processors, and intelligent workstations), nearly two thirds of all LAN applications will be in office automation networks; factory automation will account for nearly 25% of the LAN market by the end of the decade.

The LAN will be a major factor in promoting efficient office and factory integration. Three major segments of the LAN market will be high-speed data links between mixed mainframe/minicomputer networks; the connection of standalone PCs and intelligent workstations; and the integration of office equipment such as print servers, file servers, and word processors.

As of 1985, the LAN market is shared by seven different technologies, each in a different stage of evolution. (Fig. 2 estimates each classification's share of the total LAN market in 1987.)

Baseband bus. This kind of LAN, currently available from Digital Equipment, Datapoint, Xerox, Interlan, and 3Com, will maintain a strong position in the near term based on the wide acceptance of the Ethernet standard and on product offerings from several strong vendors.

Broadband bus. This existing product category, offered by Wang, Ungermann-Bass, Interactive Systems/3M, and others, will also remain strong, based on a significant installed base and an anticipated need for high bandwidth capabilities in the future. Applications will become more spe-

The LAN will be a major factor in promoting efficient office and factory integration.

cialized toward the end of the decade, however.

Centralized LAN. This product will follow the centralized control and access scheme of the PBX, and it will provide an alternative to more distributed control baseband, broadband, and token-ring LANs. AT&T will be a powerful force in the centralized network market based on its strength in communications networks and the twisted-pair wiring it already has in offices. These LANs will gain market appeal on the strength of a centralized approach as local networks increase in size and number.

Token ring. By 1988 this product will be important because of its networking efficiency and flexibility, IEEE standards activity, IBM's endorsement, and the integration of token-ring LANs into some PBXs. There will be a growing need to connect multiple-ring LANs in office networks.

Token bus. Because of the need for high throughput of more bursty data flow than is typical in the office, this will be the primary LAN for factory automation applications. The sequential flow of a token around a ring would be cumbersome for most factory networks. General Motors' endorsement of the token bus is likely to be seconded by other large factory networks in the next couple of years.

Third generation PBX. Star configured digital PBXs with up to 64Kbps data capacity will meet many local area data needs over the next five years. Their ability to integrate voice and data over existing networks will add benefit to many applications. Enhancements to this class of PBX will produce interfaces to accommodate co-existing LANs and PBXs.

Fourth generation PBX with integrated LAN. In 1985 several of these products will be available; very high bandwidth and data management features will allow users to establish networks and then add data traffic to existing voice capabilities as needed. The success of the PBX vendors in the local area network market will depend on their ability to offer such integrated PBX/LAN products.

Five major criteria will determine what LAN solutions end users will choose for the next three to five years: increased data traffic, physical distribution, network control, local transmission media, and interfaces beyond the LAN.

NEEDS NOT GREAT TILL LATE '80s

End users will realize that many local area networking needs can be sufficiently served by third and fourth generation PBX equipment, and that their need for truly high bandwidth capacity will not be real until the late

FIG. 1

LAN TOPOLOGY—ALTERNATIVES AND RELATIVE PERFORMANCE

	BUS	RING	STAR
Information throughput	Decreases with each added node	Decreases with each added node	Dependent on capacity of central node
Flexibility	High	Moderate	Low
Expandability	High	Moderate	Dependent on capacity of central node
Connectivity cost	Moderate	Low	Initially high, incrementally low
Reliability	High	Low	Moderate

FIG. 2

U.S. LAN MARKET SHARE, BY CLASSIFICATION



SOURCE: ARTHUR D. LITTLE INC. ESTIMATES

Many LAN needs can be sufficiently served by third and fourth generation PBX equipment.

1980s. Voice/data integration and predominantly asynchronous networks will be better served by PBX alternatives.

In addition, users with high data-capacity needs will be able to cost-effectively upgrade their data networks by using latest-generation PBXs with LAN-based data architectures. The presence of an in-place, twisted-pair wiring network in a PBX will affect short-term decisions regarding the purchase of a LAN.

Increasingly, users will view either the IBM Cabling System or AT&T's universal wiring plan as a comprehensive, long-term local network solution. But early commitments to either distribution scheme will be more a function of allegiance to AT&T or IBM rather than to the particular product solution.

Within the local area network, centralized control will become more widespread as end users realize its benefits for predominantly asynchronous and nonintelligent nodes.

Network topology and access schemes will be more important than media in most local area network selections, as multimedia products are offered by many vendors. There will be more mixing of media within single local area networks as LANs continue to grow in size and number of installations. By 1990, optical fiber backbones and twisted-pair branches will coexist and comprise the largest share of high-capacity networks.

LAN decisions will more and more be based on LAN interfaces to wide area networks (WANs), networks that extend beyond the local campus or building. Users will realize that a LAN is only part of a total solution to data communications needs and that choosing a certain LAN may make the benefits of interface with specific WANs impossible. These interfaces will be even more important to end users concerned with the integration of voice, video, and data throughout their entire networks.

By 1992, user needs will have produced a different set of LAN characteristics: baseband bus and broadband bus LANs will see continued sales growth through 1990 but their markets will be smaller than in 1985. The bus LANs will lose market share to a combination of token ring LANs, centralized LANs, and integrated PBX/LANs.

Ethernet baseband systems will remain strong, based on their success in the market through 1985 and their acceptance by computer and office equipment manufacturers, including Digital Equipment, Xerox, and Intel.

Broadband bus LANs will consist mainly of networks with relatively few high-bandwidth nodes—these will predom-

FIG. 3

U.S. LAN MARKET SHARE, BY CLASSIFICATION

1992



SOURCE: ARTHUR D. LITTLE INC. ESTIMATES

inate in many industrial applications, including CAD/CAM.

INCREASE IN TOKEN-RING LANs

The number of token-ring LANs installed will grow significantly through the mid-1990s. In some cases, the token-ring LAN will be complete in itself, while in other cases multiple rings will be linked through star-wired PBXs. Alliances currently forming between computer and communications vendors—the IBM acquisition of Rolm, for example—illustrate this trend. Because multiring networks will be very large, it will be most efficient to link them via the centralized control of a star-wired PBX.

PBX vendors will continue to increase the data capacity and LAN features of their

products. Significant market-share gains will be realized by 1990 for those vendors who are able to install voice/data systems before late 1986, when broadband token rings become solidly established.

In the early '90s, the token bus will remain the dominant LAN for factory automation applications, especially for large networks with many nodes. Smaller factory networks may be served by a mix of baseband and broadband LANs with factory applications enhancements. Other communications vendors may follow the lead of AT&T in offering non-PBX, centralized LANs. Centralized-control LANs will be particularly well suited for those networks largely composed of dumb devices.

Three major categories of competitors will pursue the LAN market through

Centralized control of a LAN will become even more critical as LANs grow in size and complexity.

the 1980s: computer/office equipment vendors, communications equipment vendors, and specialized LAN vendors.

The majority—65%—of LANs already in operation have been installed by the computer/office equipment vendors including Digital Equipment, Xerox, Prime, Wang, and Datapoint, and the rest—35%—by specialized LAN vendors such as Corvus Systems, Proteon Associates, Sytek, 3Com, Interlan, and Ungermann-Bass.

The following competitive trends will develop over the next 10 years:

1985-1987. Major PBX vendors, including AT&T, Northern Telecom, Rolm (IBM), NEC, and Intecom, will increase their collective market share in local area networking applications. End users will find that these vendors' PBXs have sufficient capacity to handle their near-term data needs. End users who make this PBX commitment will look to these vendors to offer integrated LANs within the PBX network to meet their longer-term data traffic needs. The PBX vendors will gain local area networking market share mainly at the expense of existing baseband LAN vendors.

AT&T's ISN LAN will become a significant entry in the market as end users recognize the benefits of its standard twisted-pair wiring, its centralized control features, and its growth potential via fiber optics. The ISN will accommodate distributed processing among intelligent devices while it provides centralized administration of the local network.

The specialized LAN vendors will direct more attention to LANs in factory automation. This will be a response to the increasingly crowded office LAN market (especially after the entry of AT&T and IBM) and also to a growing number of factory workstations that will need to be linked.

1988-1994. Fig. 3 shows an estimate of the relative market share for each sector of the total LAN market in 1992. The IBM Cabling System will have so penetrated the market that IBM could override the advantage of PBX twisted-pair wiring networks with the Cabling System's flexible arrangement of twisted pairs, broadband coaxial cables, and optical fibers.

Centralized control of a LAN will become even more critical as LANs grow in

size and complexity, in both the office and factory. AT&T's ISN will be well established by 1988-1990, and IBM will have successfully merged Rolm's PBX technology into its LAN offerings. There is likely to be an IBM/Rolm PBX with sufficient capacity to centralize multiple token rings in a star configuration.

AT&T, IBM, and any other future centralized local area network vendor will capture the major shares of high-capacity local area networking applications, but through the early 1990s, there will not be a clear winner in the battle between AT&T and IBM.

The specialized LAN vendors will face moderating growth from 1985 to 1990 and a gradual decline thereafter through 1994. In response to this gradual shakeout, many vendors will pursue industry-specific application niches by the early 1990s. Customized application software packages will be a major opportunity for go-it-alone or joint development with AT&T and IBM. ●

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Heart disease or stroke can cheat you out of the best years of your life.

Those are the years shared with people you love. And when a loved one is gone, everything changes. You can't imagine the loss, unless it happens to you. Last year, nearly one million Americans died of heart disease and stroke — 200,000 of them before retirement age.

The American Heart Association is fighting to reduce early death and disability from heart disease and stroke with research, professional and public education, and community service programs.

But more needs to be done.

You can help us save young lives by sending your dollars today to your local Heart Association, listed in your telephone directory.



American Heart Association

WE'RE FIGHTING FOR YOUR LIFE